United States Patent [19]

Dattilo et al.

[11] **4,305,652**

[45] **Dec. 15, 1981**

[54] **MERGING OF INFORMATION IN A COPIER-PRINTER SYSTEM**

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[73] Assignee: **International Business Machines Corporation,** Armonk, N.Y.

[21] Appl. No.: **95,481**

[22] Filed: **Nov. 19, 1979**

[51] **Int. Cl.**[3] **G03G 15/00**

[52] **U.S. Cl.** **355/6;** 355/77

[58] **Field of Search** ..... 355/7, 3 R, 6, 23–26, 355/35 H, 14 SH, 77; 101/DIG. 13

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Primary Examiner—R. L. Moses

Attorney, Agent, or Firm—Fraser and Bogucki

[57] **ABSTRACT**

Non-coded and coded information are merged in a copier-printer system by copying the non-coded information onto one or more sheets of paper during a first pass of the sheets of paper through the system and thereafter selecting the sheets of paper with the non-coded information copied thereon from the secondary or duplex paper trays of the system for a second pass through the system during which coded information may be printed on the sheets of paper. Selection of the sheets of paper having non-coded information copied thereon is integrated with sheets of paper from the primary tray which are to contain exclusively coded information. Copying of the non-coded information and printing of the coded information is carried out under the control of mag cards indicating the pages and page locations within a given document where the non-coded information is to be copied and in some cases containing coded information to be integrated with the non-coded information.

In one method, non-coded information is copied on sheets of paper which are then electronically collated and inverted before being removed as a stack from the exit tray and placed upside down in the secondary tray for subsequent integration with sheets from the primary tray as coded information is printed. In an alternative method, the sheets of paper having non-coded information copied thereon are collected in the duplex tray with each sheet then being cycled through the system without copying or printing thereon so as to be inverted upon return to the duplex tray in preparation for printing of coded information. In a further alternative method, sheets of paper onto which the non-coded information has been copied are removed from the exit tray and thereafter selected from the secondary tray to make a complete set of copies which is thereafter used as originals to make further sets of copies.

15 Claims, 12 Drawing Figures

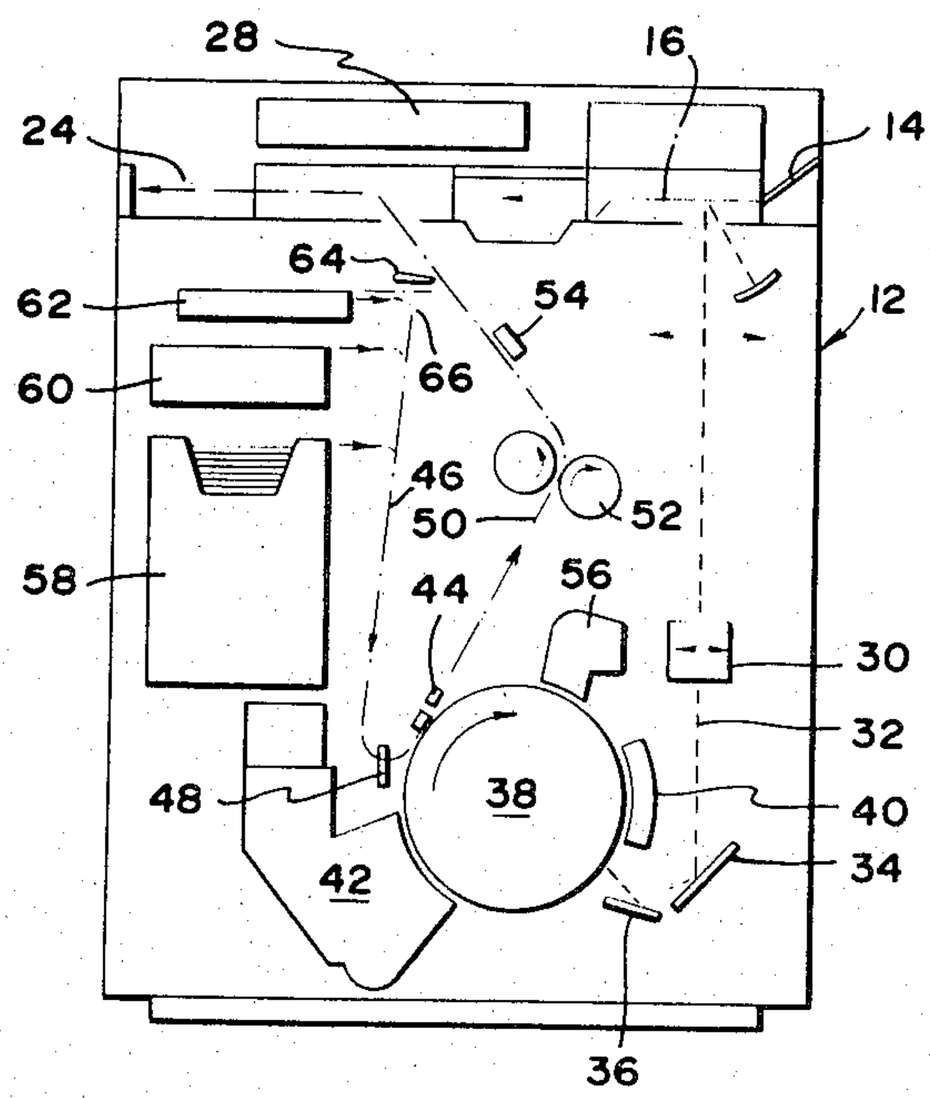


FIG. 1

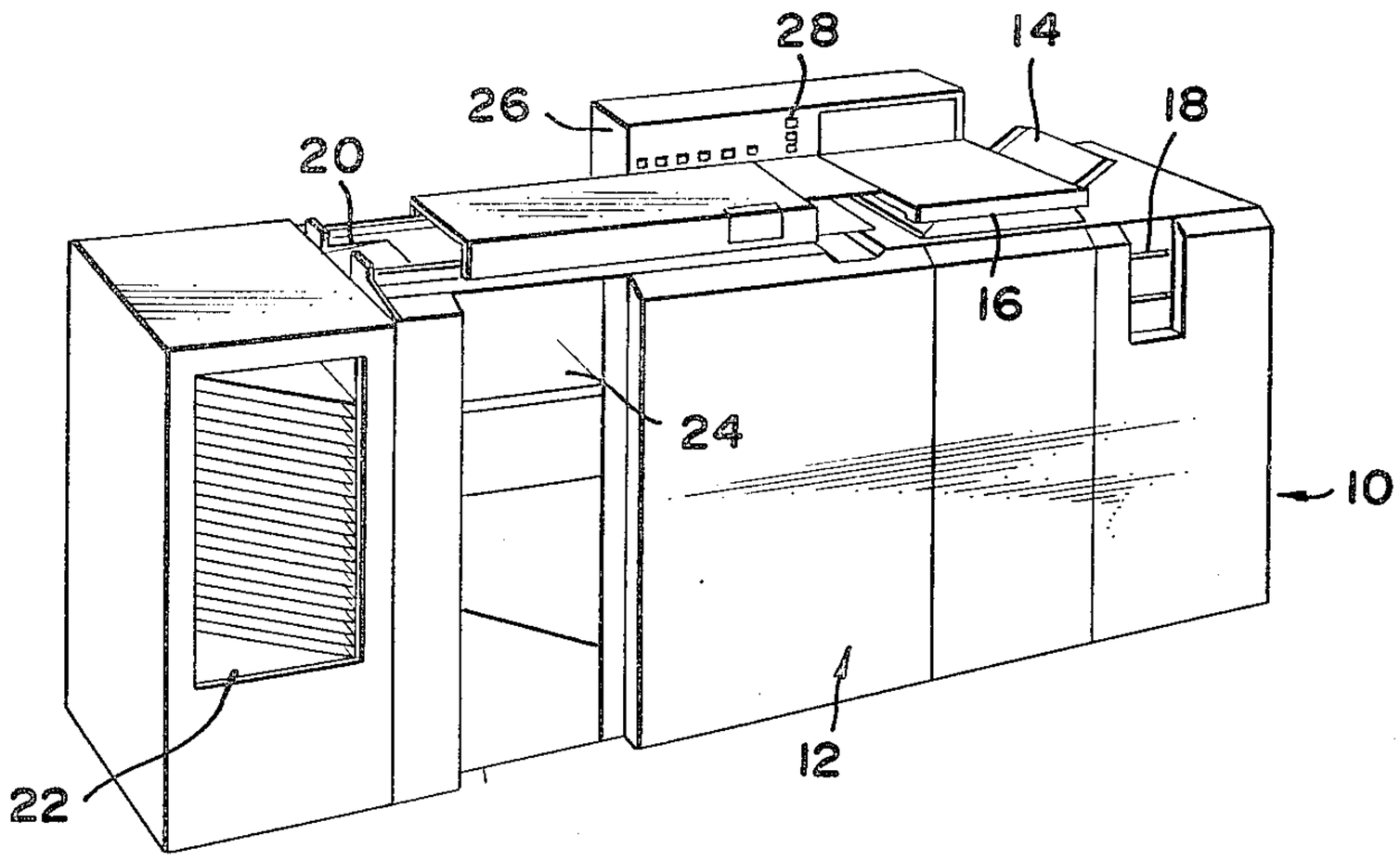

28
14
26
18
20
16
24
10
22
12

FIG. 2

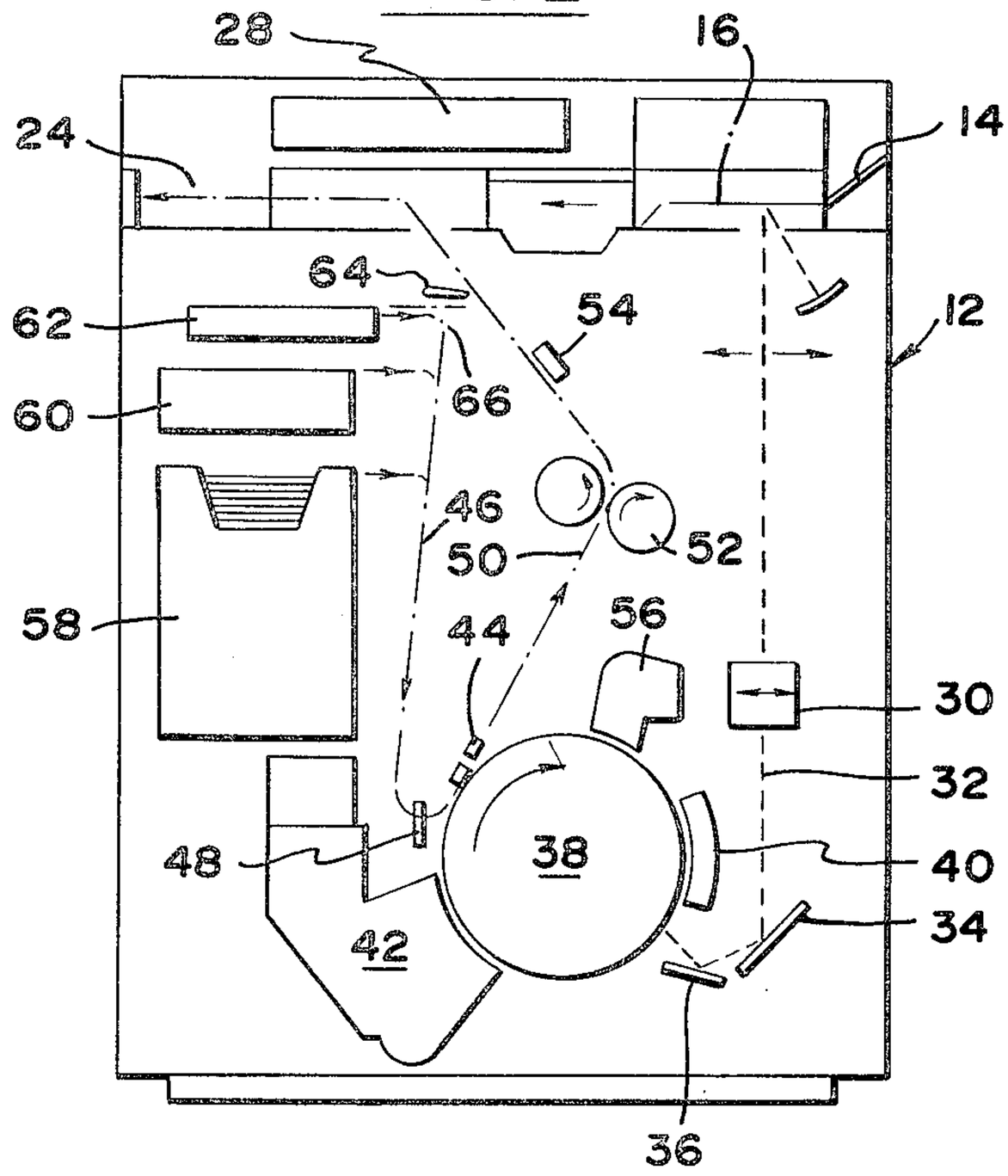

28
16
24
14
64
62
54
12
66
60
46
50
52
58
44
56
30
32
48
38
40
42
34
36

FIG. 3

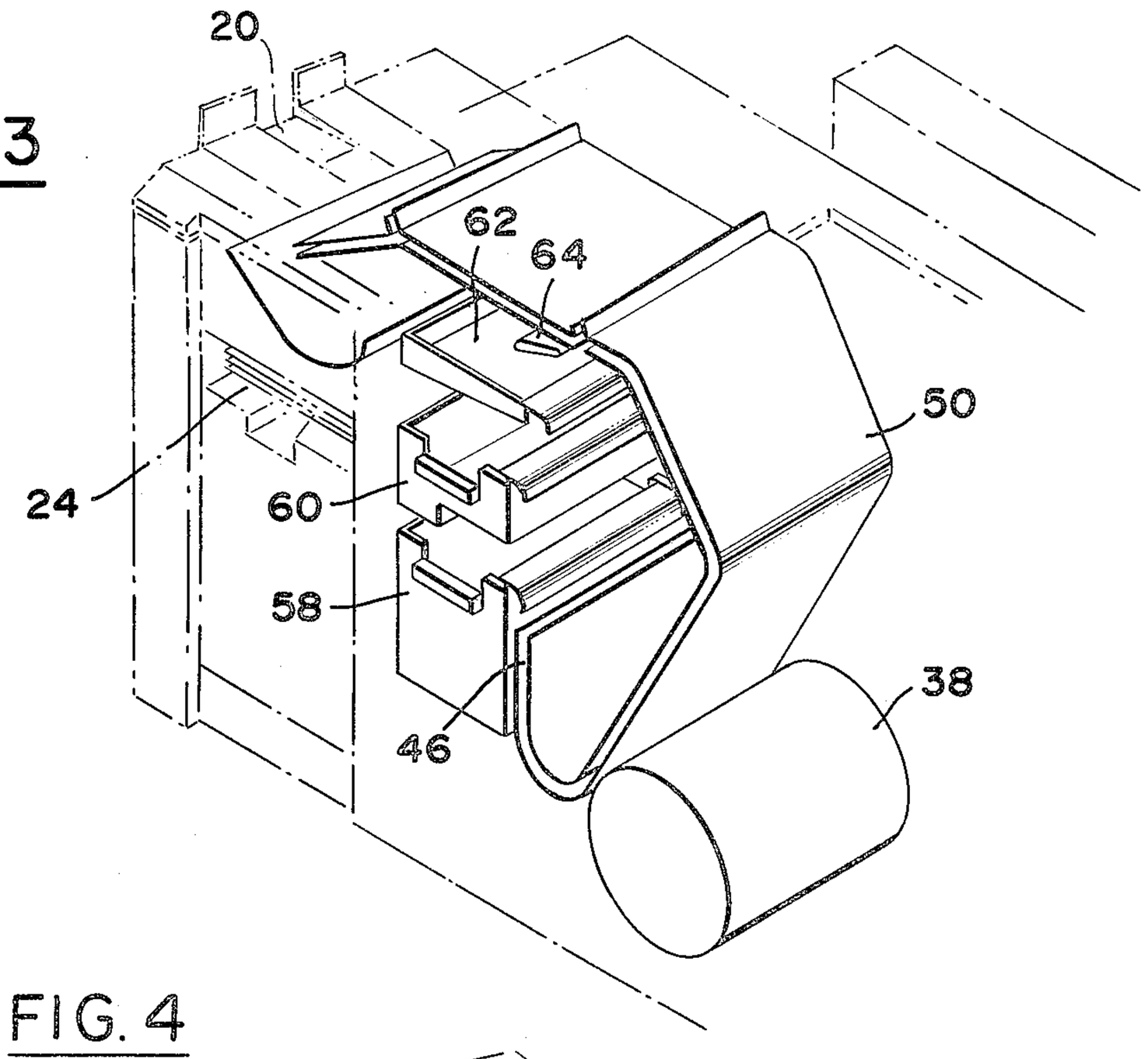
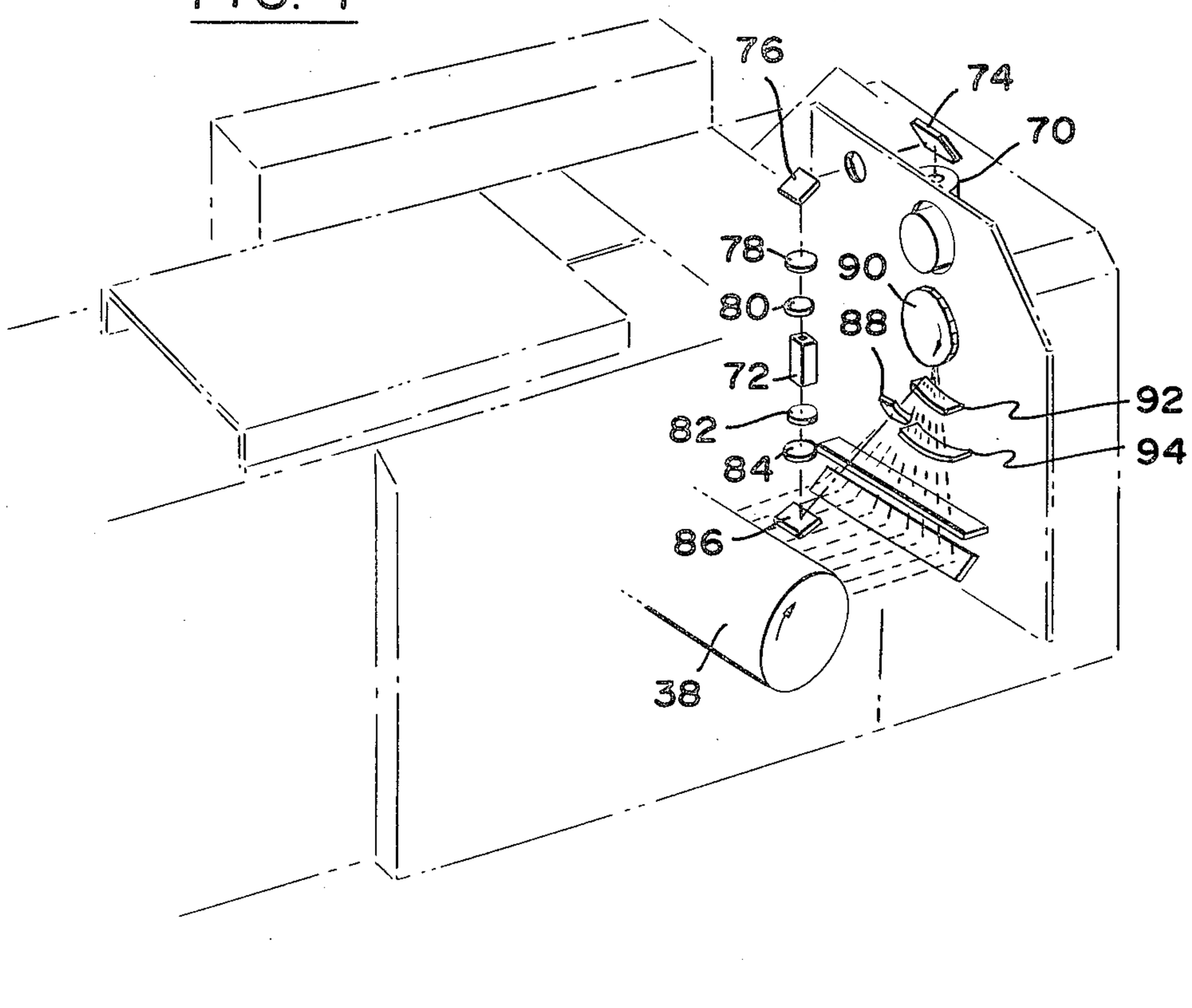


FIG. 4



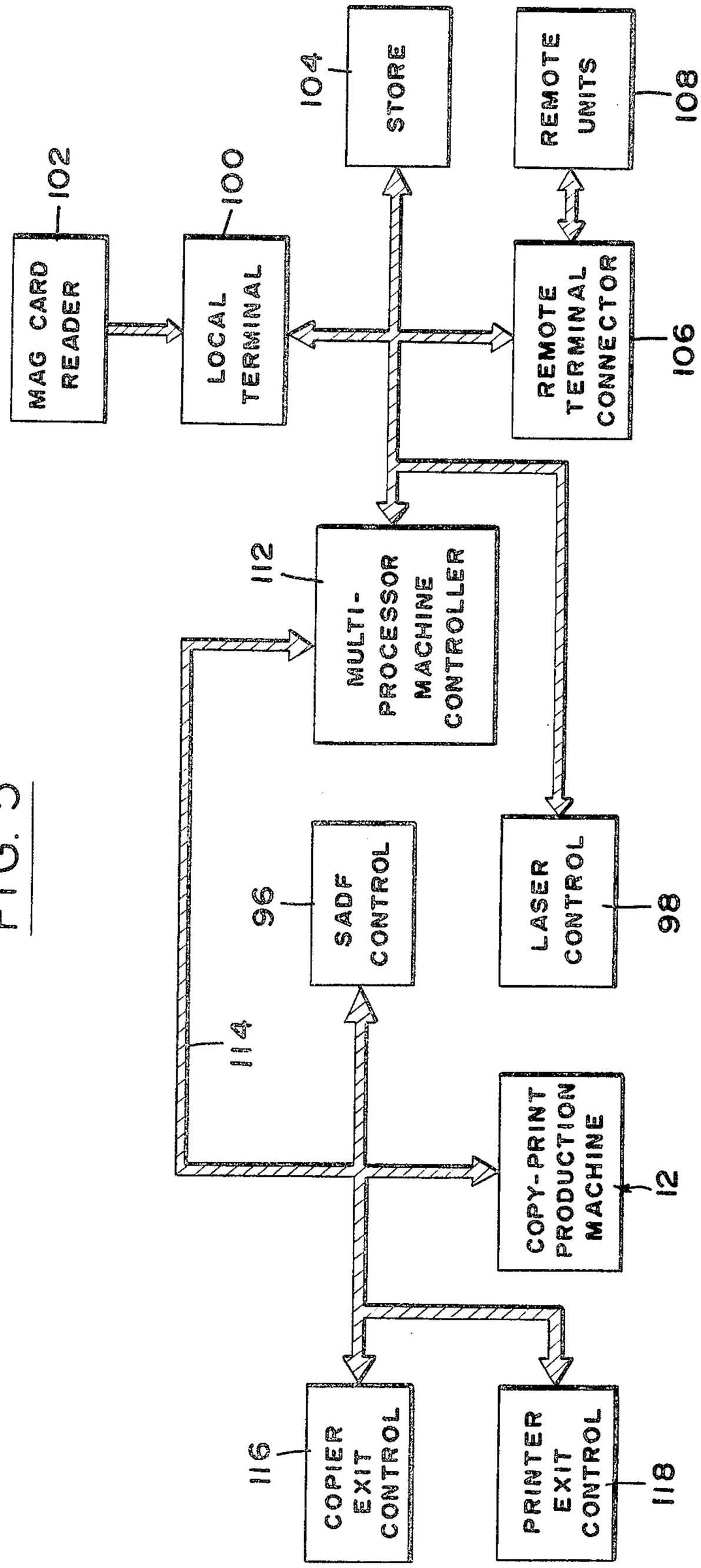

STORE
104
REMOTE UNITS
108
102
100
MAG CARD READER
LOCAL TERMINAL
REMOTE TERMINAL CONNECTOR
106
112
MULTI-PROCESSOR MACHINE CONTROLLER
96
SADF CONTROL
LASER CONTROL
98
114
COPY-PRINT PRODUCTION MACHINE
12
116
COPIER EXIT CONTROL
PRINTER EXIT CONTROL
118

FIG. 5

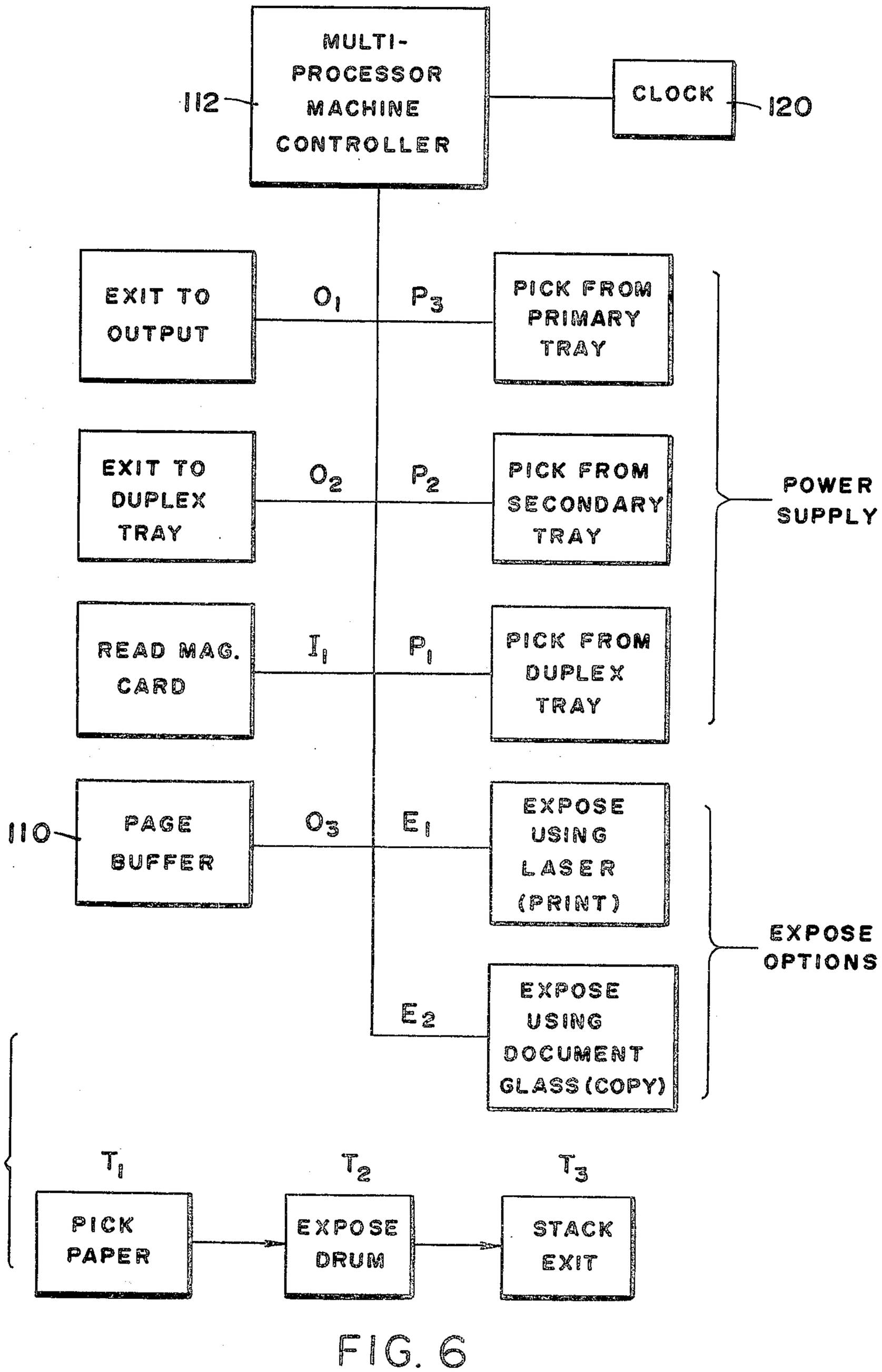

MULTI-PROCESSOR MACHINE CONTROLLER
112
CLOCK
120
EXIT TO OUTPUT
O_1
P_3
PICK FROM PRIMARY TRAY
EXIT TO DUPLEX TRAY
O_2
P_2
PICK FROM SECONDARY TRAY
READ MAG. CARD
I_1
P_1
PICK FROM DUPLEX TRAY
POWER SUPPLY
110
PAGE BUFFER
O_3
E_1
EXPOSE USING LASER (PRINT)
E_2
EXPOSE USING DOCUMENT GLASS (COPY)
EXPOSE OPTIONS
T_1
T_2
T_3
PICK PAPER
EXPOSE DRUM
STACK EXIT

FIG. 6

FIG. 7A

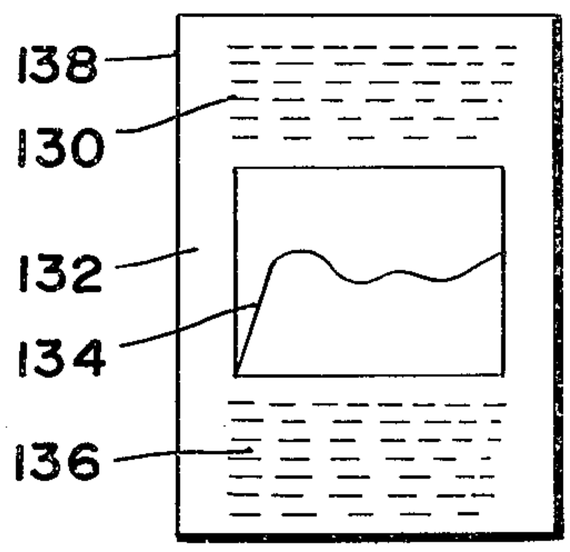
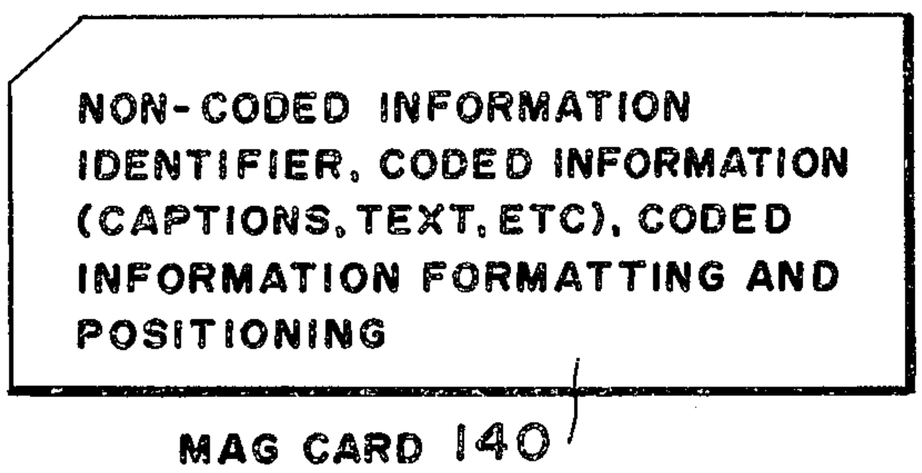


FIG. 7B



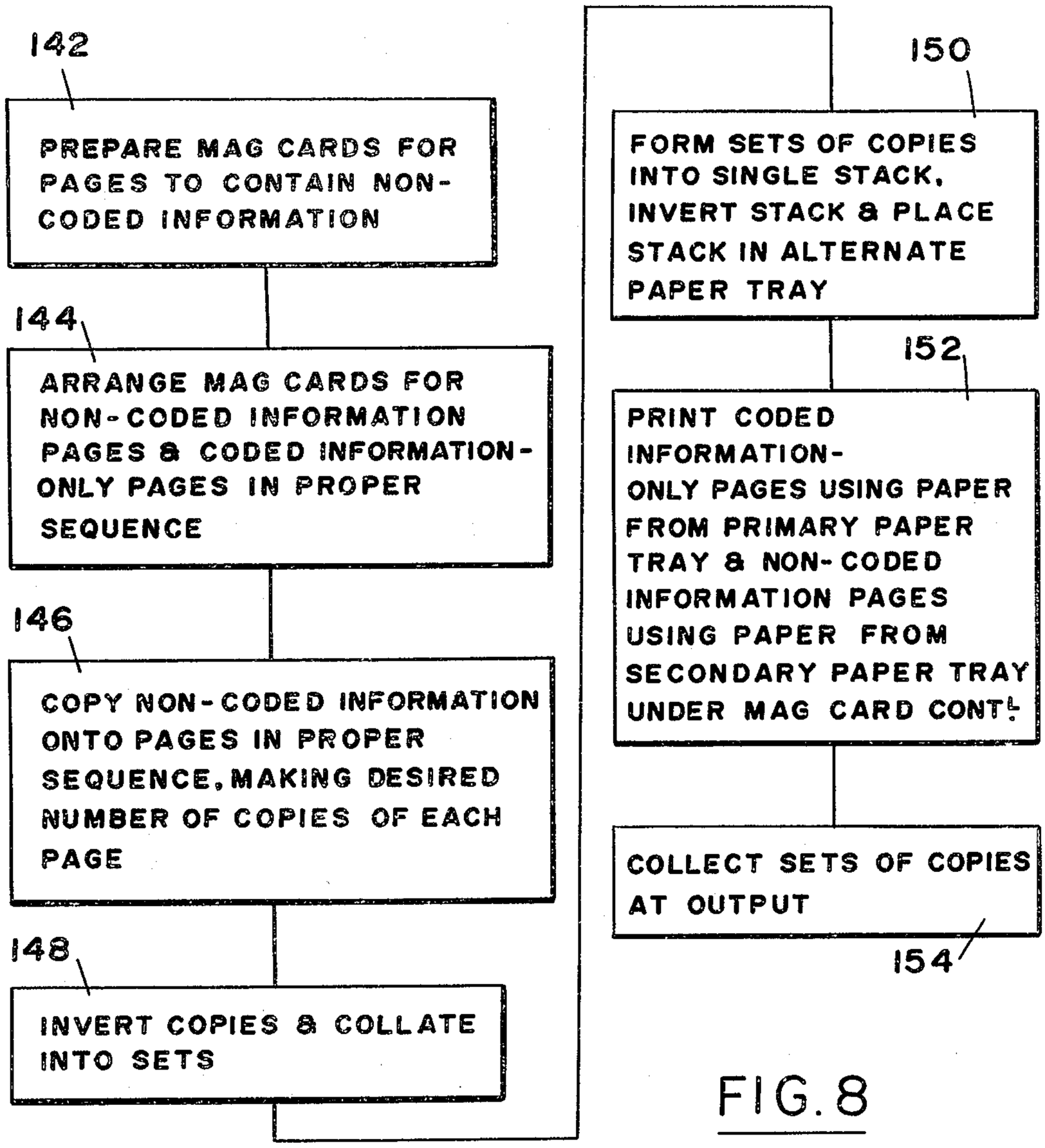


FIG. 8

FIG. 9

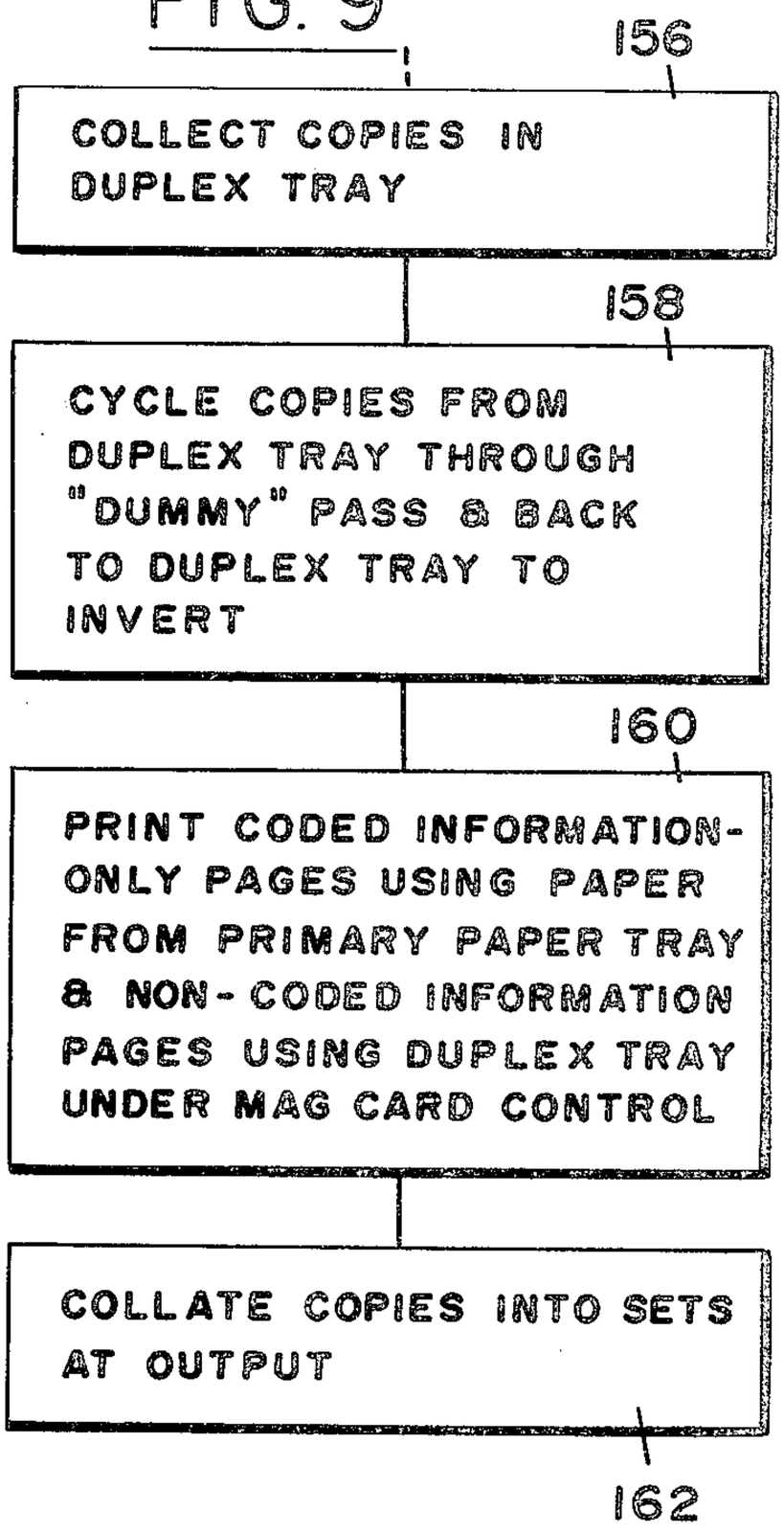
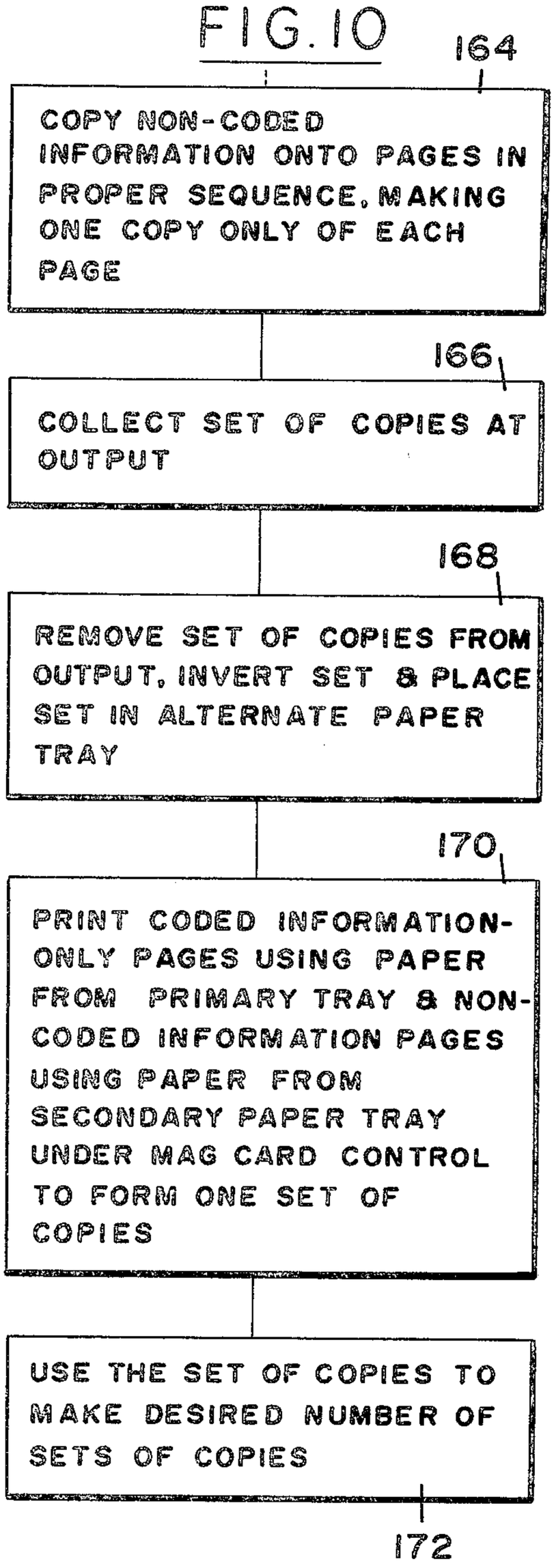


FIG. 10



	T1	T2	T3
EXAMPLE OF FIG. 8	P3	E2	O1
	P2 or P3	E1	O1
EXAMPLE OF FIG. 9	P3	E2	O2
	P1	–	O2
	P1 or P3	E1	O1
EXAMPLE OF FIG. 10	P3	E2	O1
	P2 or P3	E1	O1
	P3	E2	O1

FIG. 11

MERGING OF INFORMATION IN A COPIER-PRINTER SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to copier-printer systems, and more particularly to systems capable of printing coded information as well as copying information from original documents onto sheets of paper using a xerographic or similar printing process.

2. History of the Prior Art

It is known to provide copier-printer systems which are capable of copying information from original documents onto sheets of paper and printing coded information on other sheets of paper using a xerographic or similar printing process. An example of such a system is provided by International Business Machines 6670 (IBM 6670) Copier-Printer System. A co-pending application of Roger E. Kuseski, Ser. No. 802,095, filed May 31, 1977, entitled Copy Production Machines and commonly assigned with the present application describes processor control of the IBM 6670 Copier-Printer system including control of the system during copying of non-coded information from original documents and during printing of coded information. Such copying and printing are carried out as separate and independent operations with one interrupting the other where necessary. Thus, there is no suggestion or description of how the non-coded information copied from original documents could be integrated with the printing of coded information to form a single document of one or more pages which combines the two different types of information. Such a capability would be most useful, for example, in the case of a document where charts, graphs or similar non-coded information is desired to be merged within the document and preferably within individual pages of the document with coded information which may consist of figure numbers, legends or other explanatory text in conjunction with the charts or graphs as well as other text.

Various other patents describe portions of the IBM 6670 Copier-Printer System and similar types of systems. Such patents include U.S. Pat. No. 4,046,471 of Branham et al which describes a copying capability in a laser printer, U.S. Pat. No. 4,000,486 of Schomburg which describes character generation and the use of a magnetic card reader and a page memory within a copier-printer system and U.S. Pat. No. 3,898,627 of Hooker et al which provides further description of character generation including laser image generation and serialization of data for printing. Patents which describe specific portions and features of copier-printer systems include U.S. Pat. No. 4,089,516 of Colgazier et al which describes a system having primary, secondary and duplex paper trays, U.S. Pat. No. 4,068,839 of Bullock et al which describes output bins and the manner in which paper can be inverted prior to entry into the bins and U.S. Pat. No. 4,044,232 of Hubbard which describes use of a duplex tray within a processor controlled copier-printer system. U.S. Pat. No. 4,054,380 of Donohue et al provides a further example of a processor controller copier-duplicator.

Still other patents which are of interest with respect to copier-printer systems include U.S. Pat. No. 3,949,145 of Ricards et al which discloses the merging of text from a computer or memory with illustrations physically stored in the device, U.S. Pat. No. 3,946,591

of Hill et al which shows a font selection for a printer where different fonts are stored in separate memories and selected during printing, U.S. Pat. No. 3,744,899 of Sable which discloses a method for printing variable data on documents and xerographically overprinting appropriate forms on the printed data in a second set, and U.S. Pat. No. 3,936,180 of Willard et al which describes a xerographic printing system having an additional input providing for overlay of forms.

As noted above it would be desirable to be able to merge different types of information in a copier-printer system so that, for example, non-coded information and coded information could be merged in a given document calling for both the copying of non-coded information and the printing of coded information. None of the systems and equipment therefor described by the above patents provide this capability.

Accordingly, it is an object of the invention to provide a method and apparatus for merging different types of information such as non-coded and coded information in a copier-printer system.

It is a further object of the invention to provide a method and apparatus in which non-coded information copied from original documents and coded information to be printed can be provided on different pages of a given document or even merged onto the same pages within the document using mostly available copier-printer hardware.

BRIEF DESCRIPTION OF THE INVENTION

Copier-printer systems in accordance with the invention merge different types of information in a given document by using different passes of the various sheets of paper of the document through the system to enter the different types of information. In the case where non-coded information copied from original documents is to be merged with printed matter produced by coded information, sheets of paper to have non-coded information copied thereon are first cycled through the system to copy the non-coded information thereon. Thereafter, the sheets of paper are placed in other than the primary paper tray such as in the secondary or duplex tray from which they are selected for integration with sheets of paper from the primary paper tray which are to have exclusively coded information printed thereon. The sheets of paper selected from the secondary or duplex paper trays undergo a second pass through the system, during which time coded information can be printed thereon. Merging of non-coded and coded information on the sheets of paper of the document is controlled by a mag card reader in conjunction with the processor control of the copier-printer system. Magnetic cards are prepared so as to contain indications of non-coded information and the locations of such information on specific pages within the document. The cards may also contain some or all of the coded information to be printed in the document. Non-coded information is then copied during the first pass of certain pages of the document through the system, following which the magnetic cards are used to select paper from the different trays for printing of the coded information thereon.

In one preferred method of preparing a document having non-coded information merged with coded information in accordance with the invention, sheets of paper are cycled through the copier-printer system to copy non-coded information thereon from original doc-

uments. The sheets of paper are electronically collated to provide the required number of sets of copies with each sheet being inverted by the system just prior to entry of the sheet into the output bin. The resulting stack of paper sheets in the output bin having the toner side on top is then removed from the output bin, inverted and placed toner side down in the secondary tray. The process then continues with printing of coded informaton. Pages of the document comprised exclusively of coded information are printed on sheets of paper taken from the primary paper tray. The sheets of paper stored in the secondary paper tray and which have non-coded information previously copied thereon are selected under mag card control so as to be properly integrated with the sheets of paper taken from the primary paper tray. Upon selection of each sheet of paper from the secondary paper tray for a second pass thereof through the system, coded information is printed thereon as dictated by the magnetic cards.

In a second method according to the invention the desired number of copies of each page to contain non-coded information are made and collected in the duplex tray. The sheets of paper are collected in the duplex tray so that the toner side of each sheet is up and so that copies of the first page are on top, copies of the second page are thereunder and so on. The sheets of paper in the duplex tray are then integrated with sheets of paper from the primary paper tray as the coded data is printed. Each sheet of paper stored in the duplex tray upon being selected is first run through a dummy cycle of the system without copying or printing thereon simply to invert the sheet, following which the sheet is again cycled through the system with coded information being printed thereon as required. The dummy cycle can be avoided where desired by use of paper inserting apparatus in the paper path upstream of the duplex tray.

In a further method in accordance with the invention one copy of each page to have non-coded information copied thereon is made. The resulting copies are removed from the exit tray and placed toner side down in the secondary tray. One complete set of copies is then made by selecting paper from the primary and secondary trays and printing coded information thereon in the manner previously described. This complete set of copies is then used as originals to make the required number of sets of copies which are collected in the mechanical collator of the system.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings, in which:

FIG. **1** is a perspective view of a copier-printer system in accordance with the invention;

FIG. **2** is a front view of a portion of the inside of the system of FIG. **1**;

FIG. **3** is a perspective view of a portion of the inside of the system of FIG. **1**;

FIG. **4** is a further perspective view of a portion of the inside of the system of FIG. **1**;

FIG. **5** is a block diagram of control circuits forming a part of the copier-printer system of FIG. **1**;

FIG. **6** is a block diagram of a multiprocessor machine controller used in the control circuits of FIG. **5**;

FIG. 7A illustrates a typical page of a document having non-coded and coded information merged thereon;

FIG. 7B illustrates the information contained on certain magnetic cards used in accordance with the invention;

FIG. **8** is a block diagram of the successive steps of a first method in accordance with the invention;

FIG. **9** is a block diagram of some of the successive steps of a second method in accordance with the invention;

FIG. **10** is a block diagram of some of the successive steps of a third method in accordance with the invention; and

FIG. **11** is a table setting forth the various functions performed by the controller of FIG. **6** in carrying out the methods of FIGS. **8–10**.

DETAILED DESCRIPTION

FIG. **1** depicts a copier-printer system **10** which in the present example comprises an IBM 6670 system modified in accordance with the invention. Various portions of the IBM 6670 system are described in detail in the previously referred to co-pending application of Kuseski and in some of the previously referred patents including the patents to Branham et al, Schomburg and Hooker et al. As seen in FIG. **1** the copier-printer system **10** includes a copy-print production machine **12** which is shown in FIGS. **2–4** and which includes various paper supply trays and apparatus including a rotating drum and scanning laser beam for copying or printing on the paper. A document feed **14** may be used to feed documents to a document glass **16** from which they are scanned in order to produce a copy thereof within the copy-print production machine **12**. The copy-print production machine **12** is also operative to print coded data entered in the copier-printer system **10** such as from one or more magnetic cards in a card unit **18**.

Copies of documents fed to the document glass **16** are passed by the copy-print production machine **12** to a copy exit tray **20** or to a mechanical collator **22**. Where several copies of a multi-page document are being made, the mechanical collator **22** functions in well known fashion to collate the copies into sets. With the mechanical collator **22** turned off, the copies are delivered to the exit tray **20**. When the copy-print production machine **12** is used to print coded information on sheets of paper from one of the paper supply trays, such sheets of paper are normally routed to a dual exit pocket **24** adjacent the copy exit tray **20** and the mechanical collator **22**. The dual exit pocket **24** is normally all that is required for an output gathering device in the case of copying because of the electronic collation capability of the copier-printer system **10**. As described hereafter, the successive pages of a document can be stored in a non-volatile store and used to make a selected number of copy sets.

The copier-printer system **10** has a control panel **26** mounted on top and capable of controlling the various copying and printing functions of the system. The control panel **26** includes a quantity selector **28** used to select the number of copies to be made of a particular document at the document glass **16**.

FIGS. **2–4** depict some of the details of the copyprint production machine **12** within the copier-printer system **10**. Referring to FIG. **2**, a document placed on the document glass **16** is scanned by a moving lens **30** and the resulting beam **32** is reflected by mirrors **34** and **36** onto

a drum **38**. When the copier-printer system **10** is being used to print instead of copy, the beam **32** reflected from the document on the document glass **16** is replaced by a laser beam from apparatus shown and described in connection with FIG. **4**. The drum **38** comprises a photoconductor drum which rotates in the direction of the arrow past a plurality of xerographic processing stations. A first such station **40** imposes either a positive or negative electrostatic charge on the surface of the drum **38**. It is preferred that this charge be a uniform electrostatic charge over a uniform photoconductor surface. Such charging is done in the absence of light such that the projected optical images alter the electrostatic charge on the photoconductor surface of the drum **38** in preparation for image developing and transferring. In the case of FIG. **2** the beam **32** exposes the photoconductor surface of the drum **38**. Light in the projected image electrically discharges the surface areas of the drum **38** in proportion to light intensity. With minimal light reflected from the dark or printed areas of an original document at the glass **16**, there is no corresponding electrical discharge. As a result, an electrostatic charge remains in those areas of the photoconductive surface of the drum **38** corresponding to the dark or printed areas of the original document. This charge pattern is termed a "latent" image on the photoconductive surface of the drum **38**.

The next xerographic station is a developer **42** which receives a toner (ink) from a toner supply to be deposited and retained on the photoconductive surface still having an electrical charge. The developer station **42** receives the toner with an electrostatic charge of a polarity opposite to that of the charged areas of the photoconductive surface. Accordingly, the toner particles adhere electrostatically to the charged areas, but do not adhere to the discharged areas. Hence, the photoconductive surface, after leaving developer station **42**, has a toned image corresponding to the dark and light areas of an original document at the glass **16** or of the image supplied by a laser input from the printing arrangement shown in FIG. **4**.

Next, the latent image is transferred to copy paper in a transfer station **44**. The paper is brought to the station **44** from an input paper path portion **46** via a synchronizing input gate **48**. In the transfer station **44**, the copy paper is charged and brought into contact with the toned image on the photoconductive surface of the drum **38** which results in a transfer of the toner to the copy paper. After such transfer, the sheet of image bearing copy paper is stripped from the photoconductive surface of the drum **38** for transport along a path **50**. Next, the paper has the electrostatically carried image fused thereon in a fusing station **52** for creating a permanent image on the copy paper. The copy paper receives electrostatic charges in the transfer station **44** which can have an adverse effect on copy handling. Accordingly, the copy paper is electrically discharged at a discharge station **54** before transfer to the output.

After the image area on the drum **38** leaves the transfer station **44**, there is a certain amount of residual toner on the photoconductive surface. A cleaner station **56** has a rotating cleaning brush to remove the residual toner for cleaning the image area in preparation for receiving the next image projected onto the drum **38**. The cycle then repeats by charging the just-cleaned image area at the charging station **40**.

The copy-print production machine **12** has three different sources of paper sheets comprising a primary paper tray **58**, a secondary paper tray **60** and a duplex paper tray **62**. Any of the three trays **58**, **60** and **62** is capable of responding to associated pickers (not shown) to provide sheets of paper along the input paper path portion **46** in well known fashion. The primary paper tray **58** serves as the primary or principal source of sheet paper for copying or printing operations. The secondary or auxiliary paper tray **60** provides the machine **12** with greater flexibility such as in instances where a paper of different size from that used in the primary tray **58** is to be made available. As is well known in the art the duplex paper tray **62** may be used for two sided copying or printing. A duplex diversion gate **64** is actuated to an upward position for deflecting single-image copies to travel over a path **66** to the duplex paper tray **62**. The partially produced duplex copies (image on one side only) are stored in the next subsequent single-image run in which the copies receive the second image. In the next single-image run, the copies are removed, one at a time, from the duplex paper tray **62** and transported over the path portion **46** to the transfer station **44** for receiving a second image. The two-image duplex copies are then transferred to the output.

The manner in which sheets of paper are circulated from the trays **58**, **60** and **62** are past the drum **38** to the output of the copy-print production machine **12** to effect copying or printing, can be better understood with reference to FIG. **3** which is a perspective view of the appropriate portions of the machine **12**. As seen in FIG. **3** sheets of paper can be picked from any one of the three trays **58**, **60** and **62** for transfer along the input paper path portion **46** into contact with the outer surface of the drum **38** in the region of the transfer station **44** (not shown in FIG. **3**). From contact with the outer surface of the drum **38**, the sheets of paper are transferred via the path **50** to the duplex diversion gate **64** which has the capability of directing a sheet of paper into the duplex paper tray **62**. Otherwise the paper is transferred to either the copy exit tray **20** or the dual exit pocket **24**. As previously noted, operation of the copy-print production machine **12** in a copy mode typically provides the copies to the copy exit tray **20** or the mechanical collator **22** shown in FIG. **1**. Operation of the copy-print production machine **12** in the print mode normally causes routing of the printed sheets of paper to the dual exit pocket **24**, with or without the benefit of electronic collation which is a capability of copier-printer systems such as the IBM 6670.

FIG. **4** shows the basic apparatus used in the print mode of operation of the copy-print production machine **12**. A laser **70** emits a continuous beam of red light, a beam from which is deflected selectively by an acoustically modulated optical element **72**. The beam from the laser **70** is reflected by mirrors **74** and **76** through spherical lenses **78** and **80** and to the acoustically modulated optical element **72**. The spherical lenses **31** and **32** compress the laser beam to obtain adequate beam switching time. Spherical lenses **82** and **84** on the opposite side of the acoustically modulated optical element **72** from the spherical lenses **78** and **80** expand the size of the laser beam to obtain the necessary spot size on the photoconductive surface of the drum **38**.

The beam from the spherical lens **84** is deflected by a beam splitter **86** through a cylindrical lens **88**. The direction of no power of the cylindrical lens **88** is perpendicular to the axis of rotation of a multifaceted mirror **90**. After reflection from the mirror **90** the laser beam is

reshaped as a slightly eliptical spot by a cylindrical lens **92** which is also oriented with its direction of no power perpendicular to the axis of rotation of the mirror **90**. Cylindrical lenses **88** and **92** form a telescope in the direction of power of both elements which has been folded by the mirror **90**, as described for example in U.S. Pat. No. 3,750,189. A spherical projection lens **94** focuses the laser beam onto the linear scan target on the xerographic drum. Lenses **92** and **94** combine to form a lens set which focuses the facets of the mirror **90** onto the xerographic drum **38** to compensate for facet angle errors. FIG. **5** illustrates the control circuits utilized in conjunction with the copy-print production machine **12** in the copier-printer system **10**. The various control circuits are described in greater detail in the previously referred to co-pending application of Kuseski, and therefore are only briefly described herein. A plurality of image inputs are provided to the copy-print production machine **12** by an SADF control **96** and a laser control **98**. The SADF control **96** includes a document scanning optical input in optical communication with a semiautomatic document feed as shown in FIG. **2**. The laser control **98** which includes apparatus shown in FIG. **4** receives word processing indicating signals for creating an optical image.

The laser control **98** can receive signals from a local terminal **100** which is a word processing terminal for receiving word processing signal-bearing magnetic cards at an associated mag card reader **102**. Signals from the local terminal **100** are temporarily stored in a non-volatile store **104**. Additionally, for communication in an imge communication network, a remote terminal connector **106** provides signal communication to various remote units **108**. The word processing signals from the local terminal **100** are initially stored in a page buffer **110** shown in FIG. **6** and forming a part of a multiprocessor machine controller **112**. The controller **112** effects transfer of the signals to the laser control **98** for generating an image to be transferred to the copy-print production machine **12**.

The multiprocessor machine controller **112** controls all units in the copier-printer system **10**. The various closely controlled units such as the laser control **98**, the store **104**, the remote terminal connector **106** and the local terminal **100** are controlled by pairs of unidirectional buses as described in the previously referred to co-pending application of Kuseski. The other units are those related to copy production. Communication is by way of a bidirectional data bus **114** shown connected to a copier exit control **116**, a printer exit control **118**, the copy-print production machine **12** and the SADF control **96**. The printer exit control **118** directs each printed page to the dual exit pocket **24**. The copy-print production machine **12** directs each copied page to the exit tray **20**, the mechanical collator **22** or the duplex paper tray **62**.

The multiprocessor machine controller **112** is shown and described in detail in the previously referred to co-pending application of Kuseski. As described in that application the multiprocessor machine controller **112** has a production machine controlling subsystem which includes a system microprocessor for executing a set of control programs contained in a control store with the page buffer **110** shown in FIG. **6** being used as a main or working store. A separate copy production machine controlling subsystem within the multiprocessor machine controller **112** communicates with the various units in the production machine controlling subsystem via various data transfer buses and includes a copy microprocessor, a control store containing programs, a working store for use as a main memory and input/output registers.

As described in the Kuseski application, the multiprocessor machine controller **112** is capable of executing various functions including the various functions shown in FIG. **6**. The controller **112** which is coupled to a clock **120** to synchronize the operation of the memories therein is for each copy or printed page capable of selecting one of three different sources of paper supply designated P_1, P_2 and P_3. P_1 represents the function in which the controller **112** causes an associated picker to pick a sheet of paper from the duplex paper tray **62** shown in FIGS. **2** and **3**. P_2 represents the removal of a sheet of paper from the secondary or auxiliary paper tray **60**. P_3 corresponds to the picking of a sheet of paper from the primary paper tray **58**.

The multiprocessor machine controller **112** is also capable of choosing between two different expose options designated E_1 and E_2 in FIG. **6**. E_2 designates the expose option in which the copy-print production machine **12** operates in the copy mode and uses the apparatus shown in FIG. **2** to copy an original document at the document glass **16** onto a sheet of paper selected from one of the paper trays **58**, **60** and **62**. E_1 defines the print mode of operation of the machine **12** in which the laser apparatus shown in FIG. **4** is used to print coded information from the store **104** or other source on a sheet of paper selected from the paper trays **58**, **60** and **62**.

As shown in FIG. **6** the multiprocessor machine controller **112** is capable of performing still other functions designated O_1, O_2, I_1 and O_3. O_1 represents an exit of the sheet paper from the copy-print production machine **12** past the duplex diversion gate **64** to the copy exit tray **20**, the mechanical collator **22** or the dual exit pocket **24**. O_2 represents the other alternative in which the exiting sheet of paper is directed by the duplex diversion gate **64** into the duplex paper tray **62**. I_1 represents the function in which a magnetic card present in the mag card reader **102** is read to determine instructions or coded information to be printed. O_3 represents the function in which information stored in the page buffer **110** is retrieved therefrom for printing.

FIG. **6** also depicts the various functions capable of being performed by the multiprocessor machine controller **112** in terms of three different times T_1, T_2 and T_3. During each cycle of the copy-print production machine **12**, the machine picks a sheet of paper from one of the paper supply trays at a time T_1. The machine does this by performing P_1, P_2 or P_3. Next, the machine **12** exposes the drum **38** at a time T_2 so as to perform one of the expose options E_1 and E_2. Thereafter, as the image from the drum is transferred onto the sheet of paper, the sheet of paper exits the machine **12** at a time T_3 with functions O_1 or O_2 being performed. In accordance with the invention non-coded information copied from original documents presented at the document glass **16** is merged with coded information from the store **104** by providing for two different passes of at least one sheet of paper of a given document through the copy-print production machine **12**. This is accomplished by picking one or more sheets of paper from the primary paper tray **58** and copying non-coded information thereon from original documents at the document glass **16** to form the pages of a given document which are to contain non-coded information. These sheets of paper are collected and then placed in the secondary paper tray

60 or the duplex paper tray 62 depending upon the particular method being used. The copier-printer system 10 is then used to print the coded information of the document. Pages containing only coded information are printed on fresh sheets of paper picked from the primary paper tray 58. Other pages having non-coded information already copied thereon are picked from either the secondary paper tray 60 or the duplex paper tray 62 and cycled through the machine 12 a second time with coded information being printed thereon as required. Such operations are controlled by the mag card reader 102 in response to information contained on one or more mag cards. The mag cards indicate which pages of the document contain non-coded information, the location of the non-coded information and some or all of the coded information to be printed in the document. Accordingly, the mag cards are used to determine paper supply during printing of the coded information as well as the locations on the various sheets of paper where the coded information is to be printed.

A typical page of a document containing merged non-coded and coded information is shown in FIG. 7A. A top portion 130 of the page is comprised of text which is typically printed from coded information. A middle portion 132 of the page depicts a graph 134 which is non-coded information that must be copied on the page. A bottom portion 136 of the page is comprised of further text which is typically printed from coded information. In accordance with the invention the page shown in FIG. 7A is made up on a sheet of paper 138 by selecting the sheet of paper 138 from the primary paper tray 58 and cycling it through the machine 12 while copying the graph 134 thereon from an original document containing the graph at the document glass 16. The sheet of paper 138 is then placed in the secondary paper tray 60 or the duplex paper tray 62 from which it is picked and sent through a second cycle in the machine 12 during which the text is printed at the top portion 130 and the bottom portion 136.

The process of making the page shown in FIG. 7A is controlled by one or more mag cards, one of which is shown in FIG. 7B. The particular mag card 140 shown in FIG. 7B contains a non-coded information identifier indicating that the particular page of FIG. 7A contains non-coded information. The mag card 140 may also contain some or all of the coded information to be printed on the page of FIG. 7A. At the very least, the mag card 140 contains coded information peculiar to the non-coded information on the page of FIG. 7A such as legends, labels and figure numbers. The mag card 140 also typically contains the coded information to be printed on the top portion 130 and the bottom portion 136 of the page of FIG. 7A. Finally, the mag card 140 of FIG. 7B contains coded information formatting the positioning information indicating the location of the non-coded information 134 on the page of FIG. 7A or in any event the areas of the page where the coded information is to be printed and which are therefore in a separate location from the non-coded information 134.

The mag card 140 of FIG. 7B can be prepared prior to or as part or the process of copying the non-coded information 134 on the sheet of paper 138. Thereafter, the mag card 140 is entered in the mag card reader 102 and the sheet of paper 138 is placed in the secondary paper tray 60 or the duplex paper tray 62. During the subsequent printing of the document, the mag card 140 first of all identifies that the particular page of the document shown in FIG. 7A has non-coded information copied thereon. This results in a multiprocessor machine controller 112 selecting the appropriate one of the papers trays 60 and 62 to pick the sheet of paper 138 for cycling through the copy-print production machine 12. As the sheet of paper 138 is cycled through the machine 12, the coded information stored on the mag card 140 is printed on the top portion 130 and the bottom portion 136 under the control of the coded information formatting and positioning information which is also contained on the mag card 140 and which indicates the proper locations for the coded data to be printed. The non-coded information identifier on the mag card 140 can comprise any conventional identifying information such as an eject code commonly used on the mag cards to initiate a particular process in a copier-printer system. The coded information formatting and positioning information can comprise information conventionally used in connection with the mag cards to perform a positioning or spacing function such as a character return function. The coded information is recorded on the mag cards in the usual fashion. Mag cards such as the card 140 can also be used to control the copying of non-coded information during the first paper pass where the copier-printer system 10 is equipped with an automatic document feeder. In other cases where the copier-printer system 10 is equipped with a semiautomatic document feeder, copying of the non-coded information is manually controlled.

FIG. 8 depicts the successive steps in one preferred method of merging non-coded information and coded information in accordance with the invention. In a first step designated 142, mag cards are prepared in the manner just described in connection with FIGS. 7A and 7B. One approach is to prepare a separate mag card for each page in the document. If this is done the mag card corresponding to each page containing only matter printed from coded information contains only the coded information. However, cards corresponding to pages containing non-coded information exclusively or in combination with coded information contain a non-coded information identifier and coded information formatting and positioning information in addition to any coded information which is to be printed on the page. During the printing phase of preparing the document the mag card corresponding to each new page is examined for the presence of a non-coded information identifier, and if one is present a sheet of paper is selected from other than the primary paper tray 58. The coded information formatting and positioning information is then used by the multiprocessor machine controller 112 to determine the locations where the coded information on the card is printed on the sheet of paper. If examination of a mag card fails to produce a non-coded information identifier, thereby signaling a page which is to contain exclusively coded information, the controller 112 proceeds to print the coded information contained on the card on the top of a sheet of paper picked from the primary paper tray 58.

In a second step designated 144 in FIG. 8 the mag cards which were prepared in the first step 142 are arranged in proper sequence in preparation for the printing phase of the process. Again, this example assumes that a separate card has been prepared for each page. While this is convenient from the standpoint of the operator being able to prepare mag card information for each page independent of the other pages of the document, it is not essential that this procedure be followed. Thus, the necessary information for many pages

can be contained on one or only a few mag cards, assuming that the information can be entered on the cards in order and without waste of substantial storage space on each card.

During a next step designated **146** in FIG. **8**, non-coded information is copied onto sheets of paper from the primary tray **58** in proper sequence and with the desired number of copies of each page being made. This is done manually by an operator using the copier-printer system **10** in conventional copy mode fashion, although as mentioned previously mag cards can be used to control this operation where the copier-printer system **10** is equipped with an automatic document feeder. The first page of the document to contain non-coded information is made by placing the original document containing the non-coded information on the document glass **16** and setting the quantity selector **28** to correspond to the desired number of copies of the document. The copier-printer system **10** is then operated in conventional copy mode fashion to make the desired number of copies of the first page to contain non-coded information. This procedure is then repeated for subsequent pages of the document containing non-coded information. The next step designated **148** in FIG. **8** is actually performed as a part of the step **146**. As the copies of the non-coded information are being made, the copier-printer system **10** is adjusted so as to provide the electronic collation as well as turnaround or inversion of each copy in the collator. Both electronic collation and turnaround can be performed in the IBM 6670 by operator actuation of a couple of switches. When this operation is completed, the collator bins contain one copy of each original in inverse order. Thus the copy of the first original is in the bottom of the bin, toner side up, and the copy of the last original is in the top of the bin, toner side up.

During a next step **150** in the method of FIG. **8** the copies are removed from the collator bins and piled into one stack. This stack is then inverted and placed in the secondary paper tray **60** so that the toner side of each sheet of paper is down.

During a next step designated **152** in FIG. **8** the mag cards which are prepared in the step **142** are used to control printing of coded information. Pages containing only coded information are printed on sheets of paper selected from the primary paper tray **58**, while pages containing non-coded information are selected from the stack of copies previously placed in the secondary paper tray **60**. During the print mode of operation, electronic collation is again used so that a first copy of the document is made with all of the pages thereof in proper sequence, followed by the second copy of the document and so on. As the sheets of paper are cycled through the machine **12** during the print mode, they are caused to exit to the dual exit pocket **24**. During a final step **154** in the method of FIG. **8** the different sets of copies of the document are collated in the dual exit pocket **24** and then removed therefrom.

The various functions performed by the multiprocessor machine controller **112** in carrying out the method of FIG. **8** are shown at the top of FIG. **11** at the three different times T_1, T_2 and T_3. During the copy mode P_3 is chosen automatically by operating the copier-printer system **10** in conventional copy mode fashion. This also results in selection of E_2 to expose the original documents at the document glass **16** and the selection of O_1 causing the copies to exit to one of the outputs rather than to the duplex tray **62**. During the print mode which is preceded by inverting and loading the stack of copies from the output in the secondary paper tray **60**, the mag cards dictate either P_2 or P_3 at T_1, depending on whether each page contains non-coded information or not. The mag cards also cause the copier-printer system **10** to operate in the print mode with coded information from the mag cards or other appropriate source being used to print on the paper copies in conventional fashion. At T_3 the printed copies exit to the dual exit pocket **24**.

In the alternative method shown in FIG. **9**, the first three steps of such method are identical to the steps **142**, **144** and **146** of the method shown in FIG. **8**. However, the making of copies in step **146** is done with the control button for the duplex paper tray **62** pushed so that the duplex diversion gate **64** diverts the outgoing copies for collection in the duplex paper tray **62**. This is noted in a step **156** in FIG. **9**. The copying is done with the electronic collator turned off so that copies of the first page of non-coded information are contained at the bottom of the duplex paper tray **62** with copies of the next page stacked on top thereof, and so on.

The copies enter and are stored in the duplex paper tray **62** toner side up. It is therefore necessary to invert the copies before the print mode of operation can take place. This is accomplished by picking each copy out of the duplex paper tray **62** and passing it through a dummy cycle and back to the duplex paper tray **62** to invert the copies as noted in a next step **158** in FIG. **9**. The dummy cycle is accomplished by turning off the charge corona and transfer corona of the copy-print production machine **12**. No printing of coded information is done on the sheets during the dummy cycle, the sole purpose of such cycle being to invert each sheet in the duplex paper tray **62**.

The dummy cycle can be avoided if the copier-printer system **10** is equipped with paper inverting apparatus, as is the case with both the IBM Series III and IBM 6670 with collator. Such apparatus, an example of which is provided by U.S. Pat. No. 2,901,246 of Wagner, is inserted in the paper path upstream of the duplex tray and perform the function of inverting the sheets of paper having non-coded information copied thereon during the first pass thereof through the copier-printer system **10**.

After each sheet has passed through the dummt cycle and has been returned to the duplex paper tray **62**, or has otherwise been inverted, the print mode of operation is begun. This is noted as a step **160** in the method of FIG. **9**. The step **160** of FIG. **9** is like the step **152** of FIG. **8** except that the non-coded information pages are picked from the duplex paper tray **62** rather than the secondary paper tray **60**. In addition, the print mode is not carried out using electronic collation. Instead, the requisite number of copies of each page is made before going on to print the next page. The various printed copies are then collated into sets of copies using the mechanical collator **22** shown in FIG. **1** as noted in the next and final step **162** in the method of FIG. **9**.

The example of FIG. **9** in terms of functions performed by the multiprocessor machine controller **112** is shown in the middle portion of FIG. **11**. During the copying mode of operation, the same functions are selected at T_1 and T_2 as in the case of FIG. **8**. However, at T_3 the copies exit to the duplex tray following the function O_2 because the duplex button is pressed. During the next or dummy cycle, each copy in the duplex paper tray is picked from the tray at T_1. At T_2 neither of the expose options E_1 and E_2 is chosen since no copying

or printing is to be done. At T_3 the copy is returned to the duplex paper tray. During the print mode, paper is picked from the primary paper tray (P_3) or the duplex paper tray (P_1), depending on whether each page contains non-coded information or not. The functions at T_2 and T_3 are the same as in the example of FIG. **8**.

A further alternative method in accordance with the invention is shown in FIG. **10**. The first two steps of the method of FIG. **10** are the same as the steps **142** and **144** of the method of FIG. **8**. In a third step **164** one copy only of each page containing non-coded information is made by placing the original documents in sequence on the document glass **16**. The resulting sheets of paper are cycled to the exit tray **20** where, when collected, they form one copy of each page of the document containing non-coded information. This is noted in the next step **166** in FIG. **10**.

In a next step **168** shown in FIG. **10** the stack of copies collected in the exit tray **20** is removed, inverted and placed in the secondary paper tray **60**. Inversion of the stack results in each sheet being placed toner side down in the secondary paper tray **60**. Consequently, each sheet when picked from the secondary paper tray **60** is properly oriented to present the toner side for printing thereon when contacting the drum **38**.

During a next step **170** shown in FIG. **10** the mag cards prepared and arranged in the first two steps are used to control the printing of coded information. Only one copy of each page of the document is made at this point. Pages of the document containing only coded information are printed on sheets of paper taken from the primary paper tray **58**. Pages of the document containing non-coded information are selected from the secondary paper tray **60** with coded information being printed thereon as required during the second pass thereof through the copy-print production machine **12**. When this step is complete the dual exit pocket **24** contains one set of copies of the document. During the final step designated **172** in FIG. **10** the set of copies is used as a set of originals to make the desired number of copies of the document. Thus, each page of the set of copies is placed on the document glass **16** and a requisite number of copies made thereof. The copies at the output are directed into the mechanical collator **22** which collates the copies into the desired sets of copies of the document.

Referring to the bottom portion of FIG. **11** it will be seen that in the method of FIG. **10** the process of copying the non-coded information involves the same functions P_3, E_2 and O_1 as in the methods of FIGS. **8** and **9**. Likewise, the printing of coded information involves the same functions P_2 or P_3, E_1 and O_1 as in the print modes of operation of the methods of FIGS. **8** and **9**. In the final step of the method of FIG. **10** the functions P_3, E_2 and O_1 of the first part of the method of FIG. **10** are repeated as the desired number of copies of the document are made.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A method of merging coded and non-coded information in a xerographic copier-printer comprising the steps of:

copying non-coded information onto a given side of a sheet of paper during a first pass of the sheet of paper through the xerographic copier-printer; and

printing coded information onto the given side of the sheet of paper during a subsequent pass of the sheet of paper through the xerographic copier-printer.

2. The invention set forth in claim **1**, wherein the copying of the non-coded information is performed on each of a plurality of different sheets of paper during a first pass of the different sheets of paper through the xerographic copier-printer, and the printing of the coded information is performed on each of the plurality of different sheets of paper during a subsequent pass of the different sheets of paper through the xerographic copier-printer.

3. A method of merging first and second groups of information in a xerographic copier-printer comprising the steps of preparing a record member to represent the kind and location of information to be placed on the sheet of paper, copying a first group of information onto a sheet of paper under the control of the record member during a first pass of the sheet of paper through the xerographic copier-printer and printing a second group of information onto the sheet of paper under the control of the record member during a subsequent pass of the sheet of paper through the xerographic copier-printer.

4. The invention set forth in claim **3**, wherein the first group of information comprises non-coded information and the record member comprises a magnetic card containing a non-coded information identifier and formatting and positioning information for the non-coded information.

5. A method of making a multi-page document containing coded information and having at least one page containing non-coded information, comprising the steps of:

providing a copier-printer having a primary paper tray, a secondary paper tray, an output bin and an arrangement for selectively inverting paper prior to entry into the output bin;

copying non-coded information onto at least one sheet of paper from the primary paper tray using the copier-printer;

inverting the at least one sheet of paper prior to entry into the output bin of the copier-printer;

removing the at least one sheet of paper from the output bin and placing it in the secondary paper tray of the copier-printer; and

printing coded information on a plurality of sheets of paper in sequence using the copier-printer to form a multi-page document, pages of the document containing only coded information being printed on paper taken from the primary paper tray and pages of the document containing non-coded information being comprised of the at least one sheet of paper taken from the secondary paper tray.

6. The invention set forth in claim **5**, wherein the step of printing coded information includes taking the at least one sheet of paper from the secondary paper tray and printing coded information thereon.

7. The invention set forth in claim **5**, wherein the step of copying non-coded information onto at least one sheet of paper from the primary paper tray comprises sequentially copying non-coded information onto a plurality of sheets of paper from the primary paper tray to form a desired number of sets of copies of the non-coded information, the sets of copies being provided by electronic collation within the copier-printer and being

presented as sets with each page thereof inverted at the output bin, the step of removing the at least one sheet of paper from the output bin and placing it in the secondary paper tray comprises removing the sets of copies from the output bin and placing them in the secondary paper tray, and the step of printing coded information comprises printing the coded information on the first set of copies in the secondary paper tray with any pages containing only coded information being printed on paper taken from the primary paper tray to form a first set of copies of the multi-page document and repeating for each set of copies stored in the secondary paper tray.

8. The invention set forth in claim **5**, wherein the copier-printer has a magnetic card reader for controlling printing, and further comprising the step of preparing at least one magnetic card to represent the pages of the multi-page document, the magnetic card including a non-coded information identifier and information representing the location of non-coded information for each page to have non-coded information copied thereon, the step of printing coded information including using the card reader and the at least one card to select the paper tray from which each sheet of paper is taken and to control the copying and printing of information on the sheets of paper.

9. The method of making a multi-page document containing coded information and having at least one page containing non-coded information, comprising the steps of:

providing a copier-printer having a primary paper tray and a duplex paper tray;

repeatedly copying non-coded information onto sheets of paper from the primary paper tray to form a desired number of copies of at least one page containing non-coded information using the copier-printer, the copies being stored in the duplex paper tray of the copier-printer;

inverting each copy stored in the duplex paper tray by cycling the copy through the copier-printer without copying or printing thereon and returning the copy to the duplex paper tray; and

printing coded information on a plurality of sheets of paper using the copier-printer to form a desired number of sets of copies of a multi-page document, pages of the document containing only coded information being printed on paper taken from the primary paper tray and pages of the document containing non-coded information being comprised of the at least one page, the copies of which are comprised of paper taken from the duplex paper tray.

10. The invention set forth in claim **9**, wherein the step of printing coded information includes taking sheets of paper from the duplex paper tray and printing coded information thereon to form copies of the at least one page.

11. The invention set forth in claim **9**, wherein the step of repeatedly copying non-coded information comprises repeatedly copying non-coded information onto sheets of paper from the primary paper tray to form a desired number of copies of a first page containing non-coded information using the copier-printer and repeating as necessary to form a desired number of copies of a second and subsequent pages containing non-coded information using the copier-printer, and the step of printing coded information includes printing coded information on paper taken from the duplex paper tray to form the desired number of copies of each page of the document containing non-coded information.

12. The invention set forth in claim **9**, wherein the copier-printer has a magnetic card reader for controlling printing, and further comprising the step of preparing at least one magnetic card to represent the pages of the multi-page document, the magnetic card including a non-coded information identifier and information representing the location of non-coded information for each page to have non-coded information copied thereon, the step of printing coded information including using the card reader and the at least one card to select the paper tray from which each sheet of paper is taken and to control the copying and printing of information on the sheets of paper.

13. A method of making a multi-page document containing coded information and having at least one page containing non-coded information, comprising the steps of:

providing a copier-printer having a primary paper tray, a secondary paper tray and an output bin;

copying non-coded information onto at least one sheet of paper from the primary paper tray using the copier-printer to form a copy of a page containing non-coded information, the copy being passed to the output bin;

removing the copy from the output bin and placing it in the secondary paper tray of the copier-printer;

printing coded information on a plurality of sheets of paper in sequence to form a set of copies of a multi-page document using the copier-printer, pages containing only coded information being printed on paper taken from the primary paper tray and pages containing non-coded information being comprised of paper taken from the secondary paper tray; and

using the set of copies of the multi-page document formed by the prior step to make further sets of copies of the multi-page document as desired using the copier-printer.

14. The invention as set forth in claim **13**, wherein the step of copying non-coded information comprises copying non-coded information onto a plurality of sheets of paper from the primary tray in sequence to form a copy of each of a plurality of pages containing non-coded information and the step of removing the copy from the output bin comprises removing the copy of each of the plurality of pages containing non-coded information from the output bin and placing the copy in the secondary paper tray of the copier-printer.

15. The invention set forth in claim **13**, wherein the copier-printer has a magnetic card reader for controlling printing, and further comprising the step of preparing at least one magnetic card to represent the pages of the multi-page document, the magnetic card including a non-coded information identifier and information representing the location of non-coded information for each page to have non-coded information copied thereon, the step of printing coded information including using the card reader and the at least one card to select the paper tray from which each sheet of paper is taken and to control the copying and printing of information on the sheets of paper.

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